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ABSTRACT

This study explores the current status of the delivery of mathematics instruction in General Educational Development (GED) programs in Arkansas and the relationship between the instructor's experience and background, instructional practices, support of mathematics reform, and professional involvement. The experience/background, teaching techniques/methods, training/staff development, and professional involvement of GED instructors were investigated by 57 adult education centers which house the GED programs. Results indicate that the typical GED student was performing paper-and- pencil and textbook/workbook practice; the focus of mathematics was on teaching how to manipulate numbers rather than on problem solving, critical thinking, and mathematical reasoning; and that typical GED instructors needs staff development to upgrade their own math skills. (KHR)

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Arkansas GED Mathematics Instruction: History Repeating Itself

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The advancement of technology throughout the past 15 to 20 years has transformed the workplace. The workplace is now more complex and multifaceted with changing expectations about work. Because of the changed expectations, an educated and proficient work force with a different skill set is now required.

Different mathematical skills are a component of the different skill set. Consequently, mathematical expectations in today's workplace have expanded from paper-and-pencil computation to mathematical reasoning, logic, problem solving, and connection to real-world use and application (NCTM, 1989, 2000). Carnevale (1991) maintains that the focus of mathematics skills in the workplace should be on problem solving rather than computation.

Even with the changed expectations and skills, the typical General Education Development (GED) participant is still performing pencil and paper, drill and practice of isolated computation problems that have no connection to real-world use or application (Gal, 1993). Adults who enter educational programs perceive mathematics as a barrier to upgrading skills for job advancement or for personal gratification (Gal, 1993). This perception can be a result of past classroom experiences and/or learning disabilities. However, adult educators who are given the task of helping the adult learner overcome a difficult learning history are in need of training/staff development to upgrade their own math skills as well as to change their attitudes toward mathematics (Gal, 1993). Instructors, who are often part-time, are not always prepared to teach mathematics. Furthermore, little research exists concerning how mathematics is taught to adults in GED programs and how prepared the instructors are to meet the numeracy needs of adults.

This research was adapted from a study by Mullinix (1995), *Exploring What Counts: Mathematics Instruction in Adult Basic Education*. Mullinix examined mathematics instruction in Adult Basic Education (ABE) in Massachusetts, using both quantitative and qualitative methods to obtain a comprehensive picture of the ABE mathematics learning environment.

Purpose of the Study

The primary purpose of this study was to determine the current status of the delivery of mathematics instruction in GED programs in Arkansas by investigating the experience/background, teaching techniques/methods, training/staff development, and professional involvement of GED instructors. The secondary purpose was to determine if there was a relationship between the instructor's experience/background and their instructional practices, support of mathematics reform, and professional involvement.

This study was conducted in Arkansas where 57 adult education centers house the GED programs. GED programs are housed in a variety of settings, including technical schools, community colleges, and public schools. Each setting has one or more instructors who can be at different sites within the program.

Methodology

Since a list of GED instructors was not available from the Adult Education Section, Arkansas Department of Workforce Education, a two-step process was necessary to identify the instructors. A mailing list of 57 adult education program directors was obtained from the Adult Education Section. Because two of the program directors indicated their program did not offer GED instruction, instructors from 55 programs were included in this study. Secondly, a list of all instructors teaching mathematics at each facility was obtained along with a work address for each instructor. A work address was requested so the questionnaire could be sent directly to the instructor.

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A list of 257 GED instructors was obtained from the 55 program directors. Several program directors gave their instructors an option of participating, and three program directors did not provide names of their instructors. Therefore, the sample of GED instructors used for this study is not necessarily the total number of GED instructors in Arkansas. Thirty additional questionnaires were sent to the three program directors that did not provide names or numbers of instructors. Therefore, 287 questionnaires were distributed to GED instructors. One hundred sixty nine questionnaires (59%) were returned. Of those returned, two were disqualified because the instructors did not teach mathematics. Consequently, data from 167 (58%) questionnaires were analyzed.

The demographic data obtained from the Mathematics Instruction Questionnaire included the position; teaching experience; post secondary degrees; major and minor subjects; highest level of mathematics taken in high school and college; whether mathematics is the only subject taught; the number of hours of mathematics taught per week. Additional data addressed the curriculum, instructional methods, training, and professional involvement.

Findings

Typical GED Instructor

The results of this study provided data for the following description of the typical Arkansas GED instructor: The instructor is employed full-time (56%), teaches all subjects (96%) included in the GED curriculum, and teaches mathematics between 1 and 10 hours per week (71%). The instructor has a Bachelor's degree (64%) in Elementary Education (25%) with a minor in Social Studies (15%). He or she has taught in grades 4 through 9 (87%) but has held more than one teaching job and has taught a variety of levels. The typical instructor has an average of 4 to 6 years experience (19%) teaching GED mathematics. The highest level of mathematics taken in high school and college was typically Algebra II (37%) and College Algebra (54%), respectively.

The curriculum chosen by the typical GED instructor (72%) is most often Steck-Vaughn (85%). Individual instruction (95%) and repeated practice (99%) are the instructional format and method of choice with repeated practice considered the most effective (89%) instructional method. The typical GED instructor (64%) did not participate in training related to teaching mathematics to adults in the two years previous to this study.

Knowledge and Support of Mathematics Reform Topics

Data gathered concerning the instructor's knowledge of the mathematics reform topics is presented in Table 1. As indicated, the highest percentage reported for considerable knowledge of a reform topic was 50% for problem solving. The remaining reform topics in the considerable column exhibit percentages of less than 50%. In fact, the topics that require high order thinking skills, reasoning, logic, and application fall well below the 50% level. The percentages regarding some knowledge of the reform topics are higher than those presented in the considerable column.

Table 1: Knowledge of Mathematics Reform Topics

	None	Some	Considerable
Problem Solving	6%	44%	50%
Teaching in Context	9%	48%	43%
Reasoning	8%	50%	42%
Use of Calculators	8%	58%	34%
Communication	17%	52%	31%
Open-End Problem Solving	18%	61%	21%
Computer Spreadsheets	47%	38%	15%

As indicated in Table 2, the range of the instructor's support of the mathematics reform topics was from 84% to 34%. Instructors indicated overwhelming support for the reform topics except for computer spreadsheets. Over one third of the participants indicated no opinion on open-ended problem solving and use of calculators and 57% have no opinion concerning computer spreadsheets. Those who do not indicate support of the mathematics reform topics indicate that they have no opinion rather than that they do not support their use.

Table 2: Support of Mathematics Reform Topics

	Do Not Support	No Opinion	Support
Problem Solving	1%	15%	84%
Reasoning	2%	22%	76%
Teaching in Context	2%	24%	74%
Communication	3%	22%	63%
Open-Ended Problem Solving	6%	36%	58%
Use of Calculators	14%	34%	58%
Computer Spreadsheets	9%	57%	34%

Professional Involvement

The majority (50% to 88%) of the participants were not familiar with the journals and organizations that focus on the mathematics reform movement and the teaching of mathematics. In fact, several indicated they had never heard of the organizations and journals listed on the questionnaire. Only six participants indicated membership in a professional organization related to teaching mathematics.

Data Analysis

Data concerning curriculum, instructional methods, instructor training, and professional involvement were analyzed using the chi-square test of association and an independent t-test. Results of data analysis using the chi-square test of association revealed empty cells in the member/subscribe category of professional involvement. In order to obtain more reliable results, the member/subscribe category was recoded to be included in the familiar with category. Therefore, two categories instead of three categories were included in the chi-square analysis. The categories familiar with and not familiar with, for the purpose of this study, were the descriptors used to indicate professional involvement. In addition, an independent t-test was performed comparing the mean of the subject's number of years teaching mathematics in K-12 and their professional involvement.

A chi-square test of association was computed to compare the number of hours of training received by instructors and their professional involvement. Results indicated a relationship between the training received by GED instructors and their familiarity with professional organizations and journals that focus on teaching mathematics and the mathematics reform movement. The ratio of the instructors with no training who were not familiar with to those instructors who were familiar with professional organizations and journals was about 7:5. As the hours of training increased, familiarity with professional organizations and journals increased. The ratio of those instructors with four or more hours of training who were not familiar with to those instructors with four or more hours of training who were familiar with appropriate professional organizations and journals was about 1:4.

A chi-square test of association was calculated comparing the instructor's support of reform mathematics and their professional involvement. Results indicated the ratio of those instructors who did not support to those who did support the themes of mathematics reform and were in the not familiar with category was about 3:70. The ratio of those instructors who did not support to those who did support the themes of mathematics reform and were in the familiar with category was less than 1:90.

An independent t-test compared the mean of the participant's number of years teaching mathematics in K-12 and their professional involvement. Results indicated a relationship between the number of years the instructors taught mathematics in K-12 and their professional involvement with organizations and journals that focused on teaching mathematics and the mathematics reform movement. As the years of experience teaching K-12 mathematics increased, the instructors were more likely to be familiar with the professional organizations and journals.

Discussion

The results of this study indicated that the current status of the delivery of mathematics instruction in GED programs in Arkansas was inadequate for the GED student of the present and the future. Typically, the instructors were using textbook/workbook instructional methods (repeated practice, 99%) and an instructional format (individual instruction, 95%) that promotes a passive learning environment (Nesbitt, 1996). In addition, almost all of the instructors (96%) teach all subjects in the GED curriculum. Typically, the instructors were using a curriculum based on algorithms and were showing their students how to perform mathematics operations rather than teaching them to understand mathematical concepts (TIMSS, 1996).

Training related to teaching mathematics to adults is a major concern. Over 63% of the respondents had not received any training related to mathematics instruction in the two years previous to this study. Furthermore, the participants in a mathematics manipulative workshop provided in the spring of 1998 indicated that they had never received any training related to teaching mathematics and that training was needed (Ward, 1998).

Although the instructors indicated knowledge and support of the mathematics reform topics, those topics were not applied in the classroom setting. The use of a textbook/workbook curriculum (85%) with an individual instructional format (95%) and paper and pencil repeated practice (99%) indicated that the reform topics were not used in GED mathematics instruction. A curriculum based on these methods sets a standard of minimum expectations and deprives the student of a curriculum rich in critical thinking and problem solving.

Since this study did not have a qualitative component, it is impossible to determine the instructor's definition and understanding of the reform topics. However, the results indicated that the instructor's definition and understanding of the reform topics are defined and limited by the textbook/workbook.

The instructors were not professionally involved with organizations and journals that focus on the teaching and learning of mathematics. While the results of this study indicated a relationship between training and professional involvement, and support of mathematics reform and professional involvement, the relationship appears weak. Although the instructors indicated familiarity with professional organizations and journals that focus on the teaching and learning of mathematics and the reform movement, only six of the participants indicated membership in any of the organizations listed in the questionnaire. There is considerable difference between familiarity with an organization and supporting that organization with membership.

Recommendations

The lack of staff development and training for teaching mathematics to adults is a major concern. The instructional methods and the curriculum used by the instructors does not promote high order thinking skills, problem solving, reasoning, logic, and teaching mathematics in context. The development of an extensive staff development program that will provide instructors with new ways of teaching and thinking about mathematics is recommended.

Since there is little research concerning mathematics and adults, more should be done in all areas of adult education and mathematics instruction. Children are the focus of most of the research concerning the teaching and learning of mathematics. As a result, research based upon children is being generalized to the adult population. We need to know more about how adults learn mathematics, ways to teach adults mathematics, and if, in fact, the research for children can be generalized to adults.

This study can be used as the foundation for determining whether extensive staff development and training in alternative mathematics instruction methods impacts the delivery of mathematics instruction. Additionally, the new version of the GED test, which will be initiated in 2002, introduces the use of a calculator for part of the math test. This study can be used as a foundation for determining if the introduction of the calculator impacts mathematics instruction.

Conclusion

This study revealed the following: the typical GED student was performing paper-and-pencil, textbook/work-

book repeated practice; the focus of mathematics was on teaching how to manipulate numbers rather than on problem solving, critical thinking, and mathematical reasoning; the typical GED instructor needs staff development to upgrade her/his own math skills. This profile of a typical Arkansas GED mathematics instructor and the way mathematics is taught fits the description provided by the literature.

Furthermore, different mathematical skills and expectations are required in today's workplace. These skills and expectations encompass a broader range of knowledge and application than textbook/workbook repeated practice provides. The need for different mathematical skills points to the need for change in the way mathematics is taught.

The history of mathematics instruction is textbook/workbook repeated practice and manipulation of numbers. Mathematics instruction in GED programs in Arkansas represents history repeating itself.

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